requiring such modulation, are transmitted by the vibrations of the integrant parts of these bones, unaccompanied by muscular action.

This reasoning, Mr. Carlisle says, is suggested by the columellæ in the aves and amphibia; for, since many birds accurately imitate a variety of sounds, it may be inferred that they hear as acutely and as distinctly as mankind.

The muscles of the ossicula auditûs appear to be of the involuntary kind; their peculiar stimulus is sound, and the chorda tympani is a gangliated nerve. If the above supposition is true, the muscles may be considered as all acting together; especially as it is well known that some persons who hear imperfectly are more sensible to sounds when in a noisy place; as if the muscles were then excited to action.

It cannot, Mr. Carlisle thinks, be allowed, that the pressure of the watery fluid in the labyrinth is necessary to produce the sensation of hearing, since birds hear without any such mechanism: such pressure, however, would give increased tension to the fenestra cochleæ; and, as the membrane of that fenestra is exposed to the air contained within the cavity of the tympanum, it appears adapted to receive such sounds as pass through the membrana tympani, without exciting consonant motions in the ossicula auditûs.

In order to investigate the truth of the above opinions, Mr. Carlisle had water, at the temperature of his body, dropped from a small vial into the meatus externus, the tragus being previously pulled towards the cheek. The first drop produced a sensation like the report of distant cannon; and the same effect succeeded each drop until the cavity was filled.

In this experiment the vibrations of the membrana tympani must, he says, have been impaired, if not destroyed; yet the motions of the membrane produced by each drop of water affected the air contained in the tympanum, sufficiently to produce a sensible impression.

That something like this occurs in many kinds of sounds, is, Mr. Carlisle thinks, more than probable; and as the cochlea consists of two hollow half cones, winding spirally, and uniting at their apices, it follows that the sounds affecting either of the cones must pass from the wide to the narrow end; and the tension of the parts, in either case, will necessarily aid the impression.

On an artificial Substance which possesses the principal characteristic Properties of Tannin. *By* Charles Hatchett, *Esq. F.R.S.* Read April 25, 1805. [*Phil. Trans.* 1805, *p.* 211.]

Mr. Hatchett, after mentioning the experiments made by several eminent chemists on the substance generally called Tannin (but which he thinks would be better expressed by the word Tan), observes, that the results of those experiments have established, that tan is a peculiar substance, naturally formed, and existing in many vegetable bodies, such as oak bark, &c.; but that no one has ever

supposed it could be produced by art, unless a fact observed by Mr. Chenevix, namely, that a decoction of coffee-berries did not precipitate gelatine until they had been roasted, may be considered as an exception. Some recent experiments, however, have, he says, convinced him, that tan may be formed, not only from vegetables, but even from mineral and animal substances.

The powerful effects observed by Mr. Hatchett to be produced on resinous substances by nitric acid, and the discovery made by him of a natural substance, composed partly of resin and partly of asphaltum, induced him to extend his experiments to the bitumens. He had found, that almost every species of resin is completely dissolved in nitric acid, and so totally changed that water does not cause any separation; and that, by evaporation, a deep yellow viscid substance is obtained, equally soluble in water or in alcohol: whereas, the first effect of the above acid on some of the bitumens, for instance, asphaltum and jet, was to form a dark brown solution, whilst an orange-coloured mass was separated, which, by subsequent digestion in another portion of nitric acid, was completely dissolved, and, by evaporation, afforded a yellow viscid substance, nearly similar to that obtained from the resins. But coals, which contained little or no bitumen, did not yield the yellow substance above mentioned.

Mr. Hatchett then made a similar experiment upon charcoal, and found it was more readily dissolved than the preceding substances; no residuum was left; and the solution was of a reddish brown colour.

All the above solutions, when carefully evaporated to dryness, left a brown glossy residuum, which exhibited a resinous fracture; that left by the solution of charcoal having the most beautiful appearance.

The chemical properties of these residua were as follows:—

1. They were speedily dissolved by cold water and by alcohol.
2. Their flavour was highly astringent.
3. When exposed to heat, they smoked but little, swelled much, and afforded a very bulky coal.
4. Their solutions in water reddened litmus-paper.
5. These solutions copiously precipitated the metallic salts, especially muriate of tin, acetite of lead, and oxysulphate of iron.
6. They precipitated gold from its solution in the metallic state.
7. They also precipitated the earthy salts, such as the nitrates of lime, of barytes, &c.
8. The fixed alkalies, as well as ammonia, deepen the colour of these solutions, and, after some hours, render them turbid.
9. Glue or isinglass was immediately precipitated from water by these solutions. These precipitates were, in every respect, similar to those formed by the solutions of tan hitherto known, excepting that this factitious tan appeared to be exempt from the extract, gallic acid, and mucilage, which commonly accompany natural tan.

Mr. Hatchett, having thus discovered that tan might be so readily formed from vegetable and mineral coals, was led to examine whether it could not also be formed from animal coal. For this purpose, he

reduced a portion of isinglass to the state of coal, and digested it in nitric acid, which at first did not appear to act upon it, but at length slowly dissolved almost the whole of it. The solution resembled those which have been described, but was of a deeper brown colour; and, when evaporated to dryness, left a residuum, which, upon being examined by the re-agents employed in the former experiments, was found to produce similar effects.

It appears evident, therefore, that tan may be formed from animal as well as from vegetable and mineral coal; and it also appears, from what has been stated, that it is composed of carbon, combined with a certain proportion of oxygen. It seems, however, necessary that the carbon should be uncombined with any other substance. In support of this opinion, Mr. Hatchett mentions the following experiments:—

1. A piece of Bovey coal, which appeared like half-charred wood, upon being treated with nitric acid, formed a solution of a deep yellow colour: this solution, when evaporated, left a residuum, which, dissolved in distilled water, and examined by various re-agents, particularly by gelatine, did not show any signs of its containing tan; the predominant substance appearing to be oxalic acid.

2. Another piece of Bovey coal, which was more perfectly carbonized, afforded a brown solution, which, unlike the former, yielded a considerable quantity of tan.

3. A portion of the first-mentioned sort of Bovey coal, by being exposed to a red heat in a close vessel, and then treated as before, was thus converted, almost entirely, into tan.

4. A coal from Sussex, very like the second sort of Bovey coal, also afforded tan.

5. A piece of Surturbrand, from Iceland, yielded a similar result.

6. Deal sawdust, treated in the same manner as the former substances, afforded oxalic acid, but not any tan.

7. Another portion of the same sawdust was reduced into charcoal, which, treated as before, was thereby converted into tan.

8. Teak wood, which Mr. Hatchett had previously ascertained not to contain either gallic acid or tan, was reduced into charcoal, which was as readily converted into tan as the substances already mentioned.

Mr. Hatchett then adverts to a series of experiments he is making on the slow carbonization of vegetable substances in the humid way, a few of which, he says, he is compelled to notice, on account of their being intimately connected with the present subject. In these experiments he has observed, that concentrated sulphuric acid dissolves resinous substances, forming a yellowish brown transparent solution, which, by digestion, becomes intensely black. Concentrated sulphuric acid readily dissolves the common turpentine of the shops. If a portion of this solution be immediately poured into cold water, the turpentine is precipitated, in the state of common yellow resin. But if another portion of the same solution be, after the lapse of an hour or more, poured into cold water, the resin thus formed is not yellow,

but dark brown. If four or five hours elapse before the solution is poured into the water, the resin precipitated is found to be completely black. And if the digestion is continued for several days, or until there is no longer any production of sulphureous gas, the turpentine is converted into a black porous coal, which does not contain any resin, although a substance hereafter noticed may frequently be separated from it by digestion in alcohol.

When common resin was treated in the same manner, about 43 per cent. of the coal was obtained, which, after exposure to a red heat in a loosely-covered platina crucible, still amounted to more than 30 per cent., and appeared to possess properties very similar to those of some of the mineral coals.

Mr. Hatchett having obtained, in the manner above described, yellow resin, brown resin, black resin, and coal, from a quantity of common turpentine, dissolved a portion of each of these, and also of the turpentine, in nitric acid, and then reduced the solutions to dryness. The residua, which varied in colour, from yellow to dark brown, were dissolved in distilled water, and examined by solution of isinglass and other re-agents.

1. The solution of the residuum of turpentine was of a pale straw colour, and did not contain any tan.

2. That of the yellow resin resembled the former in every respect.

3. That of the brown resin was of a deeper yellow, but did not afford a vestige of tan.

4. That of the black resin, on the contrary, afforded a considerable portion of tan.

5. That of the coal afforded tan in great abundance.

Hence it appears, that these modifications of turpentine yield tan only in proportion to the quantity of their original carbon, progressively converted into coal.

Other substances, particularly various kinds of wood, copal, amber, and wax, when reduced into coal in the humid way, were in like manner converted into tan by nitric acid.

But tan may, Mr. Hatchett says, be artificially produced, without the help of nitric acid; for if any of the resins, or gum resins, after long digestion with sulphuric acid, are digested with alcohol, a dark brown solution is formed, which, by evaporation, yields a mass that is soluble in water or in alcohol, and which copiously precipitates gelatine, acetate of lead, and muriate of tin, but produces only a slight effect on oxymuriate of iron.

In the subsequent section of this paper, Mr. Hatchett mentions some circumstances which induce him to think that a natural process, similar to those above described, sometimes takes place in peat moors, and that tan has been, and continues to be, formed during the gradual carbonization and conversion of the vegetable matter into peat. Supposing this opinion to be correct, it seems, he says, at first difficult to conceive how the formation of tan is effected during the growth of those vegetables from which it has hitherto been obtained; but after adverting to the experiments and observa-

tions of Mr. Biggin and Mr. Davy, which show that the proportion of tan in the same trees is different at different seasons, and that it is principally contained in the white interior bark, which bark is comparatively most abundant in young trees, he observes, that there seems to be an intimate connexion between the formation of new wood and the formation of tan, in those vegetables which afford the latter; and thinks it very probable that such vegetables have the faculty of absorbing more carbon and oxygen than is required in the formation of the vegetable principles, especially of the woody fibre; and that this excess of carbon and oxygen, by chemical combination, becomes tan, which is secreted in the white interior bark, and afterwards decomposed, and employed in the formation of the new wood.

The ligneous substance of vegetables, Mr. Hatchett says, appears to be composed of carbon, oxygen, hydrogen, and nitrogen; and he has reason to think, from some synthetical experiments he has made, that tan consists of 53 parts of pure carbon, and 47 of oxygen.

In the concluding section, Mr. Hatchett observes, that the whole of the present paper may be concentrated into one simple fact, namely, that tan is composed (at least essentially) of carbon and oxygen; and that, although it has hitherto been deemed a peculiar principle, formed by nature in certain vegetables, it may, with the greatest ease, be produced, by presenting oxygen to carbon in the humid way, under the circumstances which have been described.

Since the experiments which have been related were made, Mr. Hatchett has, he says, further proved the efficacy of the factitious tan by actual practice; as he has converted skins into leather by means of tan produced from materials which, to professional men, must appear extraordinary, such as deal sawdust, asphaltum, turpentine, pit-coal, wax candle, and a piece of the same sort of skin. Allowing, therefore, that the artificial production of tan must for the present be principally regarded only as a curious chemical fact, not altogether unimportant, yet, as the principle on which it is founded has been developed, we may, Mr. Hatchett thinks, hope that a more economical process will be discovered, so that every tanner may be enabled to prepare his tan, even from the refuse of his present materials.

The Case of a full-grown Woman in whom the Ovaria were deficient. *By Mr.* Charles Pears, *F.L.S.* *Communicated by the Right Hon. Sir* Joseph Banks, *K.B. P.R.S.* Read May 9, 1805. [*Phil. Trans.* 1805, *p.* 225.]

The woman whose case is here described was born in Radnorshire in the year 1770. She was of a fair complexion, and, except when irritated, of a mild temper. In her diet she was remarkably abstemious, eating very little, either of animal or vegetable food; and if at any time she ate a hearty meal, or took several kinds of food, she was so much affected by it as to faint. She was of a costive habit,